NOAA's National Ocean Service

ROUNDTABLES

PROMOTING OCEAN AWARENESS *and a* STEWARDSHIP ETHIC

Education is an essential part of ocean stewardship. It is not enough to govern our oceans in isolation; stewardship implies that we are striving to achieve a sustainable future for the ocean realm. We must communicate the importance of responsible ocean governance to those who will be doing the governing long into the future. We must inspire young people to possess a vested interest in the oceans, just as students of the last generation were inspired by NASA's Earth orbits and its mission to the moon.

At present, four programs in the National Oceanic and Atmospheric Administration (NOAA) have Congressional mandates to conduct science education and public outreach: The National Marine Sanctuary Program (NMSP), The National Estuarine Research Reserve System, the Coral Reef Conservation Program, and the NOAA Sea Grant Program. Through these programs, NOAA has become a leader in science education and outreach. For example, the National Ocean Service's (NOS) National Marine Sanctuary Program, and NOAA Sea Grant, have partnered with the U.S. Department of Education, the National Science Foundation's Centers for Ocean Science Education Excellence, the Consortium for Oceanographic Research and Education, the JASON Foundation for Education, and other public and private organizations to promote public understanding of our nation's coastal and ocean ecosystems. NOAA's Ocean Exploration program also conducts significant education programs that connect teachers and students with ongoing ocean exploration. The Teacher-at-Sea program is another example of how NOAA is engaging educators in hands-on ocean research and discovery. Through these innovative programs, NOAA's educators have become recognized leaders in marine science education.

Improving Ocean and Coastal Literacy

NOAA's activities connect science and education through programs that provide training and information to the public, and to teachers, students, and decisionmakers. Specific educational programs are designed to help teachers and students better understand marine science and coastal management issues. Both the National Marine Sanctuaries and the National Estuarine Research Reserves offer natural venues in which students, teachers and the public can see aquatic ecosystems and learn about marine science technologies and research. Several of these educational activities rely on Web-based technology, such as the National Marine Sanctuary Program's telepresence program. Telepresence integrates live video camera feeds with diverse data such as observations collected by citizen-scientists, satellite records, and measurements collected by monitoring stations in the marine sanctuaries. Developed in partnership with the JASON Foundation for Education, the Institute for Exploration, and MOTE Marine Lab, the program allows individuals living far from the coastal zone to experience the wonders of the marine world.

One exciting Web site is the NOAA Ocean Explorer Web site (***http://oceanexplorer.noaa.gov***). It provides an innovative way for students of all ages to learn about the oceans by offering near real-time access to a series of multidisciplinary ocean explorations. A site rich in formal education materials, it also provides compelling imagery, video, and topical essays related to the ocean.

Other Web-based educational offerings include NOAA's Coral Reef Information System (CoRIS) (***http://www.coris.noaa.gov***), Coral Reef Online (www.coralreef.noaa.gov), and the Coral Reef Discovery Kit (***http://oceanservice.***

noaa.gov/education/corals/welcome.html). As a single point of access to NOAA's coral reef information and products, CoRIS provides an overview of all NOAA coral reef programs, Web sites and activities, and features peer-reviewed essays on coral reef science and current threats to reefs. The Web site also provides summaries of dynamic debates and discussions captured from NOAA's Coral Health and Monitoring Program (CHAMP) listserve, an online forum for coral reef professionals; a library of NOAA reports, data and maps; and an extensive glossary of terms. Coral Reef Online offers the latest news on current NOAA coral reef activities and funding opportunities. The Coral Reef Discovery Kit translates NOAA science for the layperson with an online tutorial (an overview of coral biology and threats to coral reefs) and a roadmap to online NOAA coral reef data and resources. Formal lesson plans outline the benefits of coral reefs to people, discuss the principle threats to reef systems, and explain how satellites are used to monitor these fragile ecosystems.

Similarly, NOAA's Clean Marina Initiative Web site (***http://cleanmarinas.noaa.gov/***) offers technical assistance to state coastal managers and marina operators who are interested in developing Clean Marina Programs and reducing polluted runoff from marina activities. The site includes a description of the program; links to clean marina guidebooks, brochures, and newsletters; funding sources; state Clean Marina Programs; and other organizations promoting clean marinas. NOAA recognizes that the Clean Marina Program plays a valuable role in protecting coastal waters from nonpoint source pollution, and is promoting the program as a way for states to meet many of the marina management requirements under the Coastal Nonpoint Program (CNP). The CNP, in turn, is driving the development of many existing Clean Marina Programs and fostering the growing interest in the initiative.

NOAA's more traditional educational activities include workshops, such as those hosted by its National Marine Protected Areas (MPA) Center. The workshops provide training and information on the basic principles and general issues surrounding MPAs. Both the MPA Center and the National Marine Sanctuary Program also publish newsletters that promote exchange of information among educators and provide information on resources and opportunities. They also provide updates on training, technology, science and research. They also serve to clarify the roles of, and decrease misconceptions about, these unique marine environments and their special conservation, recreational, ecological, historical, cultural, archaeological, and aesthetic qualities.

Sea Grant educators—in collaboration with a wide variety of museums, aquaria and environmental education facilities and natural sites—deliver aquatic science information to the public through lifelong learning experiences, including workshops, parent-and-child programs, field trips, lectures, Internet offerings, instructional and informative CD-Roms, and television and radio. These programs are designed to foster environmental literacy and encourage wise use and conservation of marine and aquatic resources among coastal residents and visitors of all ages.

Other NOAA educational and outreach programs aimed at increasing the nation's ocean literacy include children's activity books that focus on the oceans and coasts of specific geographical regions; contributions to *EnviroWriter*, a newsletter that educates journalists on environmental issues; and partnerships with other organizations to produce educational materials, such as a recent booklet on "Bays and Estuaries."

Facilitating Resource Management

NOAA offers training and technical assistance to coastal resource managers, MPA managers, and other decision-makers, including land-use planners, elected officials, regulators, land developers, community groups, environmental nonprofits, and coastal businesses. It also provides technical assistance to states and communities; supports training, education, and public awareness initiatives; and disseminates best practices in coastal and ocean management.

NOAA training programs focus on a wide variety of topics related to the coasts, including habitat conservation and restoration, biodiversity, water quality, sustainable resource management, methods and techniques to respond to oil and hazardous materials spills, alternatives to traditional suburban development, information on the management and conservation of coral reefs, habitat protection, and migratory and marine species.

Through these efforts, NOAA shares its knowledge and capabilities, and provides coastal resource managers and other decisionmakers with tools, technologies and scientific information. These programs also give professionals the opportunity to network within their fields and across disciplines, and to develop new collaborative relationships to solve complex environmental problems.

Following are five examples of NOAA technical assistance and training programs for coastal decisionmakers:

- *The Coastal Training Program, offered by the National Estuarine Research Reserves, partners with state and territorial coastal management programs to promote science-based decisionmaking around key coastal resource issues. This coastal training program encourages state and local government staff and resource managers to promote sustainable growth in coastal communities by ensuring that the integrity of the coastal environment is maintained during economic development.*
- *The NOS Office of Response and Restoration (OR^{2}R) offers training in the methods and techniques used to respond to oil and hazardous material spills. Through these courses, NOAA shares its knowledge and capabilities in effective spill response, which it has learned through years of work with other federal and state agencies, nongovernmental organizations, and private-sector partners.*
- *The MPA Center's Training and Technical Assistance Institute provides opportunities to MPA managers. Programs range from geospatial training to how to review a potential project's technical feasibility, and include the development of case studies that document "lessons learned" to inform future management efforts.*
- *The Coral Management Assistantship Program places management trainees on two-year assignments with management agencies in Puerto Rico, the U.S. Virgin Islands, Hawaii, American Samoa, and the Commonwealth of the Northern Mariana Islands. The assistants work on coral reef-related issues such as overuse, education and outreach, and land-based pollution.*
- *NOAA also produces guidebooks, such as the recently released Michigan Coastal Management Program book,* **Filling the Gaps: Environmental Protection Options for Local Governments**. *This hands-on resource helps officials develop local land-use plans, adopt new environmentally focused regulations, and review proposed development projects.*

NOAA assists resource managers by providing access to reliable and timely materials and information, as well. NOAA provides technical expertise by collecting, analyzing and distributing data on coastal/ocean trends and issues. For example, the MPA Center's searchable inventory of marine managed areas (MMAs) and MPAs is available via the MPA Web site (***http://mpa.gov***). Similarly, the National Marine Sanctuary Program's Sanctuary Integrated Monitoring Network (SIMoN) (***http://www.mbnms-simon.org***) provides timely and pertinent information

to managers and decisionmakers, the research community, and citizens interested in monitoring programs in California's Monterey Bay.

NOAA's efforts to facilitate resource management have had far-reaching impacts. Since 1994, workshops and seminars conducted via the National Estuarine Research Reserves have reached more than 13,000 coastal decisionmakers. These programs have resulted in better-informed decisions and improved coastal stewardship at the local and regional levels.

Connecting Oceans to Classrooms

NOAA educators, particularly those of the National Marine Sanctuary Program, Sea Grant, Ocean Exploration, and the National Estuarine Research Reserve System (NERRS), emphasize bringing ocean science to K-12 and college classroom teachers and students across the nation. One such program is EstuaryLive, an interactive Internet "field trip" created by the North Carolina National Estuarine Research Reserve. NERRS is the lead agency for National Estuaries Day, a partnership with the U.S. Environmental Protection Agency's National Estuary Program to promote the importance of estuaries and the need to protect them. For the past three years, EstuaryLive has reached thousands of schoolchildren, teachers, elected officials and private citizens on National Estuaries Day.

NOAA's most significant point of entry into U.S. classrooms is the JASON Project. Sponsored by the JASON Foundation for Education, the nation's leading provider of experienced-based science and math curricula and teacher professional development for grades 4-9, this project reaches more than 1.5 millions students and 34,000 teachers annually. JASON's annual expeditions and related curricula have drawn heavily upon NOAA facilities, content, and personnel, and have prominently featured the Florida Keys, Monterey Bay, Hawaiian Islands Humpback Whale, Thunder Bay, and Channel Islands National Marine Sanctuaries.

The Jacques Cousteau National Estuarine Research Reserve's Marine Activities, Resources and Education (MARE) program engages teachers, students, parents, administrators and the community in the transformation of elementary and middle schools into dynamic laboratories for the study of the ocean. The program was selected as "A Program that Works" by ten regional Eisenhower consortia funded by the U.S. Department of Education's Office of Educational Research and Improvement. Another important program that the Jacques Cousteau National Estuarine Research Reserve implements is the Coastal Ocean Observation Laboratory room (COOLroom). The COOLroom provides a series of internet-based instructional modules that link middle- and high-school classrooms with active research investigations at the New Jersey Shelf Observing System conducted by a collaboration of oceanographers studying the coastal ocean off the New Jersey coast.

Learning Ocean Science through Ocean Exploration is a newly-developed curriculum for teachers of Grades six-12. It presents lesson plans that were developed for NOAA ocean explorations and the Ocean Explorer Web site in a comprehensive scope and sequence through subject area categories that cut across the individual expeditions. Each lesson uses an inquiry-based approach to teaching and learning and is correlated to the National Science Education Standards.

NOAA also offers student internships. For example, the Coastal Management Fellowship Program places qualified master's and doctoral candidates in state and territorial coastal management programs. Established in 1996 and sponsored primarily by the NOAA Coastal Services Center, the NOS Office of Ocean and Coastal Resource

Management, and the National Sea Grant Program, the program provides on-the-job education and training for postgraduate students, and offers technical assistance to the states and territories. Similarly, the National Estuarine Research Reserve System's Graduate Research Fellowship provides master's and doctoral candidates with an opportunity to conduct research of local and national significance that focuses on enhancing coastal zone management. NERRS fellows conduct their research within a National Estuarine Research Reserve and gain hands-on experience by participating in their host reserve's research and monitoring programs.

The Sea Grant network also offers a suite of opportunities and programs to foster inter- and multi-disciplinary studies of the marine environment. It supports a wide range of experiential internships, fellowships, team-based research courses, interdisciplinary courses and programs, and traditional research assistantships that broaden the experiences of undergraduate and graduate students alike.

Other internships, offered by both the National Marine Sanctuary Program and the National Estuarine Research Reserves, target middle- and high-school students with a strong interest in marine science. The National Marine Sanctuary Program also hosts urban and/or underserved teachers and students into the sanctuaries through its Field Studies Program. Participants spend a week receiving an intensive hands-on introduction to marine science and policy issues.

Providing the nation's teachers with professional development opportunities is a priority of NOAA. The most common professional development program topics are marine biology; estuary biology; ecology; human impacts on aquatic environments; and chemical, physical, and geological sciences. Most participants teach grades six through eight, followed by those who teach upper elementary school and high school.

The National Marine Sanctuary Program's Long-term Monitoring and Experiential Training Program for Students (LiMPETS) (***http://limpets.noaa.gov***) is one example of NOAA's teacher development program. LiMPETS was developed to train educators in the scientific protocols used to collect and compile long-term data on marine ecosystems. Similarly, the Flower Garden Banks National Marine Sanctuary's Down Under, Out Yonder Program is a teacher workshop that offers classroom theory accompanied by hands-on activities, followed by scuba-diving in the sanctuary. NOAA's Teacher-at-Sea program is another example. Participating teachers spend time on NOAA research expeditions at sea, then return to their classrooms with experiences that inspire their students to learn more about ocean science.

NOAA employees also freely give of their time in their own school districts, giving presentations on coastal and ocean issues at local schools, serving as judges at science fairs, and speaking at "career days."

Promoting Ocean Awareness

As a technologically advanced nation, the United States needs a scientifically and environmentally literate public. Increasing ocean literacy will foster a citizenry that takes personal responsibility for maintaining healthy ecosystems and protecting natural resources in the public trust. An educated public can keep pace with technological advances as well as environmental issues of great complexity and scale (e.g., global climate change). Across the entire agency, NOAA is strongly committed to its leadership role in science education.